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TABLE OF CONTENTS.

President George B. Pegram, *frontispiece* 635
The Contribution of Eta Kappa Nu to the Investigation of Engineering Education. H. P. Hammond 637
Evolutionary Trends in Engineering Curricula. W. E. Wickenden 658
Engineering Degrees. H. P. Hammond 669
Program of the 34th Annual Meeting, State University of Iowa, Iowa City, June 16–18, 1926 678
Sections and Branches 686
Obituary 690

George Braxton Pegram.

PRESIDENT GEORGE B. PEGRAM

George Braxton Pegram was graduated from Trinity College, North Carolina, in 1895. He taught in the North Carolina high schools until 1899, at which time he came to New York to study for the doctor's degree in Physics. In the course of this work he was appointed Assistant in the Department of Physics at Columbia in 1901 and retained this position until 1903, in which year he obtained his Ph.D. Degree.

Immediately after this he was appointed Tutor and subsequently Instructor in Physics at Columbia.

During the period 1902 to 1906, in addition to his work at Columbia, he held an appointment under the U. S. Coast and Geodedic Survey as Magnetic Observer. In 1907 he was awarded the Tyndall Fellowship by Columbia University, and under it went abroad to study at the University of Berlin and at Cambridge University.

At the end of this period of foreign study he returned to Columbia as Assistant Professor of Physics, and in 1912 was made Associate Professor. In the year 1911 he was made Executive Officer of the Department of Physics, Columbia University, and in 1918 full Professor, and both of these positions he holds to-day.

In the year 1918 he was awarded the degree of D.Sc. (hon.) by Trinity College.

During all of this period of contact with the Department of Physics, Columbia University, Professor Pegram showed a most unusual sympathy for an understanding of engineering, and he, probably more than any other man, at Columbia, in this period worked earnestly toward the improvement of engineering courses through better understanding of Physics.

The Engineering School at Columbia as a result of actual changes found itself without a leader in the year 1917, and mainly because of Professor Pegram's sympathy and under-

standing, but also because of his demonstrated ability as a leader and administrator, he was appointed Acting Dean of the Engineering School, without relief from his duties as Executive Head of the Department of Physics and as Professor of Physics. His immediate success in the Engineering School resulted in his appointment as Dean in 1918, which position he still holds.

During the War he added still further duties to his already full schedule, and rendered valuable service to the Signal Corps for Army Photographers and to the Ordnance School of Explosives, both of which were connected with the S. A. T. C. at Columbia University. He, furthermore, directed important research work for the U. S. Signal Corps, and was Secretary of the N. Y. Local Committee on Submarine Defense, specifically engaged in research on submarine detection devices.

Professor Pegram has published the following papers, all of which have appeared in the *Physical Review:* "Secondary Radioactivity in the Electrolysis of Thorium Solutions" (Dec. 1903); "Heat Developed in a Mass of Thorium Oxide, Due to its Radioactivity" (July 1908); "Unipolar Induction and Electron Theory" (Dec. 1918).

He is a fellow of the American Association for the Advancement of Science; Fellow of the American Physical Society; Fellow of the New York Academy of Sciences; Treasurer of the American Physical Society; Treasurer of the Society of the Sigma Xi; President of the Society for the Promotion of Engineering Education; and a member of the Institute of Radio Engineers.

THE CONTRIBUTION OF ETA KAPPA NU TO THE INVESTIGATION OF ENGINEERING EDUCATION.*

BY H. P. HAMMOND,

Associate Director of Investigation.

As noted in *The Bridge* for January, 1925, the Society for the Promotion of Engineering Education is engaged in a comprehensive study of engineering education in the United States and Canada. The purposes are to determine all essential facts regarding the methods of the engineering colleges; to compile and study opinions regarding engineering education; and to plan for the future such modifications and adjustments as will best serve the abilities and needs of students and the requirements of industry and the profession.

The study has now been under way for two years. As it has progressed, the importance of certain known problems has been emphasized and others have developed to which little attention had previously been directed. For example, the emphasis and the amount of time to be give to the economic phases of engineering in college courses has been cited by many graduates and industrialists as one of the problems to which careful study should be given.

In order to obtain additional facts and opinions relating to this and to other problems, it seemed advisable to conduct a special inquiry among a selected group of men in some one engineering field, preferably one closely related to large industries. In planning this study it was thought desirable to eliminate as many variables as possible; to canvass men who are successful or give promise of success; and to obtain opinions from a group not likely to view the situation from too widely divergent standpoints of training and experience. The graduate members of Eta Kappa Nu seemed to satisfy

* Reprinted from *The Bridge of Eta Kappa Nu* for May, 1926.

these requirements admirably. The fraternity is recruited from a single engineering course. Its chapters are located in strong institutions. Its members are selected on a basis of personal as well as scholastic qualifications. Most of its alumni members are from fairly recent classes and are therefore acquainted with engineering courses substantially as they are given at present.

An invitation was therefore extended to the fraternity to contribute to the study. This invitation was generously accepted. A questionnaire was circulated by the fraternity to its members embodying seven points of importance vital to engineering education. The article which follows is an analysis of the results. Some additional facts, taken from the study of earnings which the fraternity conducted in 1923 as reported in *The Bridge* for November 1923, January 1924, and May 1924, are included.

In the present study, replies were received from 844 of the 1,714 individuals to whom questionnaires were sent, a return of approximately 50 per cent. In the study conducted by the fraternity, 1,118 replies were received from among the 1,770 individuals canvassed, a return of about 63 per cent. These percentages are high as experience in such studies has proved. It is entirely probable that the results give a fairly representative sampling of the entire membership and that they are indicative of conditions throughout the field of electrical engineering.

It was the purpose of the study to yield information and opinion on the following points:

(1) The distribution of graduates in the principal technical divisions of electrical engineering and in various functional activities of electrical engineers;

(2) The earnings of the selected group as compared with those of electrical engineering graduates in general and with those of engineering graduates of all courses;

(3) Opinions as to the relative importance of the principal groups of subjects constituting the electrical engineering curriculum;

(4) Opinions as to the importance of the study of economics in engineering courses and the need for more extended training of this type;

(5) Opinions as to the divisions of the curriculum which might be decreased with the least harm in favor of more training in economics and related subjects;

(6) Opinions as to particular subjects of the curriculum believed to be of least value;

(7) The extent to which graduates pursue some line of study after leaving college and the kinds of study most often pursued.

I. Distribution of Electrical Engineering Graduates in Various Kinds of Activity.

A number of the problems of engineering education must be viewed in light of the lines of occupations of graduates. In the past, accurate knowledge in this regard has been meager. Guesses and opinions have too often be advanced as facts. A misstatement which is very often heard, for example, is that "over half of all engineering graduates leave engineering work for other fields." Of special importance is the distribution of graduates among the several functional types of activity (research, design, supervision, management, commercial, etc.). The data contained in this report give an unusually clear picture of this situation in the field of electrical engineering. These data are briefly summarized in the following table and diagrams.

It must be remembered in examining this table that a considerable number of those in the miscellaneous manufacturing and unclassified groups as well as a few in some of the other groups are not in the field of electrical engineering. It therefore appears that electrical manufacturing absorbs fully half of those graduates who remain in electrical engineering work. It may be noted also that over 55 per cent. are employed by large industrial concerns or public utilities. Big industry, in the field of electrical engineering at least, appears to absorb a large proportion of the engineering graduates of the country.

TABLE I

	No.	Per Cent.	Totals Per Cent.
Power Production and Transportation			
Large Central Stations	140	13.0	
Small Central Stations	24	2.2	
Electric Railways	17	1.6	16.9
Communications			
Telephone Operating Companies	155	14.4	
*Telephone Manufacturing Companies	68	6.3	20.8
Total in Public Utilities, including telephone manufacturing companies	404		37.7
**Manufacturing and Contracting*			
Large electrical manufacturing companies	191	17.8	
Medium size electrical manufacturing companies	55	5.1	
Small electrical manufacturing companies	15	1.4	
Miscellaneous manufacturing	121	11.3	35.6
Contracting	37	3.4	39.0
Miscellaneous			
Teaching	53	4.9	
Government Employ	26	2.4	
Jobbers	17	1.6	
Unclassified	154	14.3	23.3
TOTALS	1,073		100.0

Figure 1 shows the distribution of Eta Kappa Nu alumni members in *electrical engineering, other engineering* and *non-engineering* work. Slightly more than 61 per cent. of the entire number are in the electrical engineering field, 22 per cent. are in other engineering lines and 16.5 per cent, are in non-engineering activities. These figures differ slightly from those compiled for the graduates of all engineering courses. The Eta Kappa Nu men show a larger proportion in electrical engineering (61.4 per cent. against 56.7 per cent.), about the

*(If the number employed in telephone manufacturing companies be added to that in other lines of manufacturing, instead of to the communications group, the percentage in manufacturing is increased to 45.3, that in communications is reduced to 14.4 and the total in public utilities is reduced to 31.3).

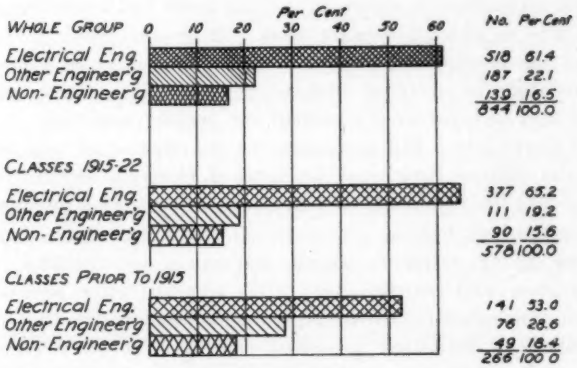


FIG. 1. Occupational distribution of Eta Kappa Nu Alumni.

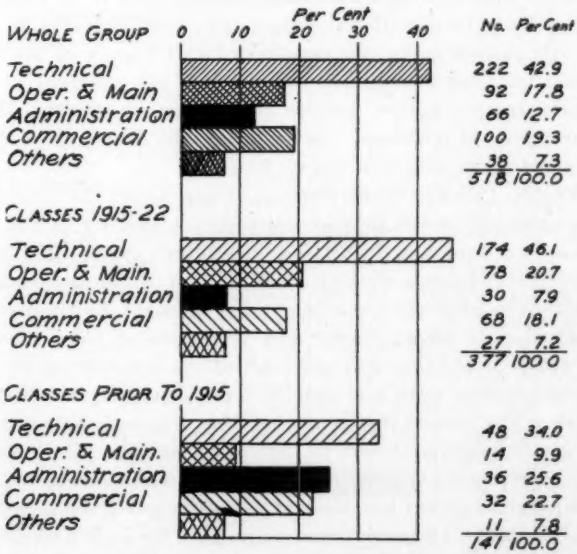


FIG. 2. Occupational distribution in various functional activities. Electrical engineering group.

same proportion in other engineering work and a smaller percentage in non-engineering work. It is interesting to note that the members of the more recent classes show a larger percentage in electrical engineering. This is to be expected and may be considered a normal and healthy condition.

Figures 2 to 5 inclusive show the distribution of graduates in the various functional divisions of electrical engineering. The data have been grouped in a few rather than a number of classifications, namely, (1) technical, including such activities as designing, research, testing, inspection, and the like; (2) operation and maintenance; (3) administrative activities, including executive direction, management, and the like; (4) commercial activities, including sales; (5) other activities. These diagrams are worthy of careful study. One feature of the analysis has been emphasized by shading. It will be seen that the relative proportions of men engaged in work which is primarily administrative in nature have been indicated by the heavily shaded parts. In considering this feature of the diagrams, it must be remembered that *not all* positions of an administrative nature involve greater responsibilities than other types of positions. Nevertheless, the differences shown by some of the diagrams are striking.

Figure 2 shows the distribution of Eta Kappa Nu men who are employed in the field of electrical engineering in the five groups of functional activities mentioned above. The first part of the diagram shows the distribution of the entire group of 518 men while the second two parts show the distribution of graduates of recent classes and graduates of older classes. It will be noted that 12.7 per cent. of the entire group are in administrative work and that 42.9 per cent. are in technical work. The second two parts of the diagram show that a larger proportion of men in the older classes are in administrative work than in the recent classes. This gain in the administrative group has been at the expense of the technical and operation and maintenance groups. There is a small increase in the proportion in commercial work.

Figure 3 shows the same analysis for men in *other* engi-

neering activities. The same shift from technical and operation and maintenance activities to administrative work between the recent and older classes is indicated. The proportion in commercial activities is about the same in the recent and older classes.

Figure 4 shows the same distribution in *non*-engineering activities. As might have been expected none of this group is in technical work and only a small number in operation and maintenance. Over half of the entire group are in work of an administrative or executive nature.

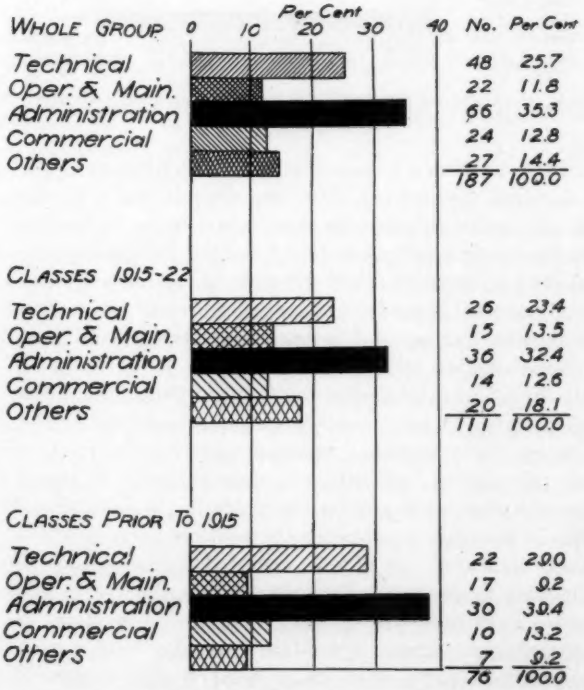


FIG. 3. Occupational distribution in various functional activities. Other engineering group.

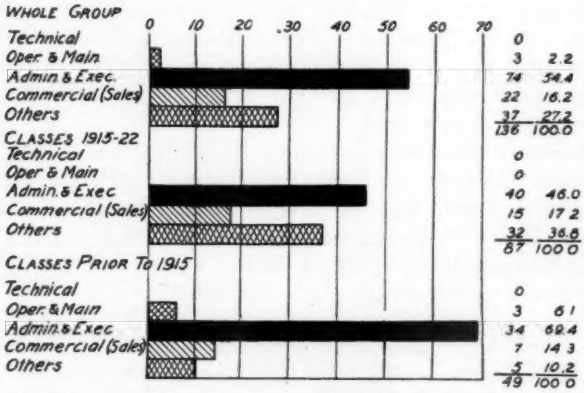


FIG. 4. Occupational distribution in various functional activities. Non-engineering group.

Figure 5 shows a comparison of the distribution of the men in electrical engineering, other engineering, and non-engineering. In order to make the comparison more distinct, operation and maintenance has been grouped with technical work and the proportions in "other" and commercial activities have been grouped together. The comparison of proportions in the technical group and in the administrative and executive group is striking.

It should be remembered in studying these figures that the total number of men must be considered as well as the percentages. The fact that technical work of design, research, and the like is entered by a large majority of the graduates and that work of this character is the normal starting place in the road to promotion to positions of responsibility is clearly indicated. It is to be expected that the proportion of graduates in the non-engineering group who are in administrative work would be greater than the proportions in the other groups. Again, it must be remembered that not all of the positions, particularly those filled by the younger graduates, which are designed as administrative in character, are of greater importance or involve greater responsibilities and

remuneration than many of the positions designated as technical in character.

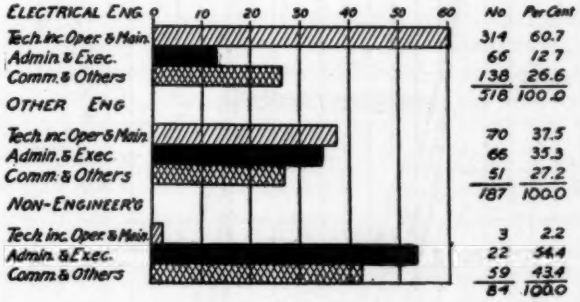


FIG 5. Comparative distribution three groups of men in functional activities.

II. EARNINGS.

Figure 6 shows curves of earnings obtained from the Eta Kappa Nu study of 1923 and from a similar study conducted in 1924 by the Society for the Promotion of Engineering Education. In the Eta Kappa Nu study, 1,118 men of all classes of 20 years or less experience supplied information. In the S. P. E. E. study 4,907 graduates of the classes of 1924, 1923, 1922, 1919, 1914, 1909 and 1904 supplied information, 1,386 of these being electrical engineering graduates. A few Eta Kappa Nu men probably answered the S. P. E. E. questionnaire as well as that circulated by the fraternity and are thus included in both groups. There is probably not a large enough number of such men however, seriously to affect the comparison of results.

The middle curve of the S. P. E. E. data is based on median values (the median is the middle number and has as many numbers larger than itself as it has numbers smaller than itself). The middle Eta Kappa Nu curve is based on averages. The general tendency is for averages to exceed medians slightly. The upper S. P. E. E. curve is the lower boundary

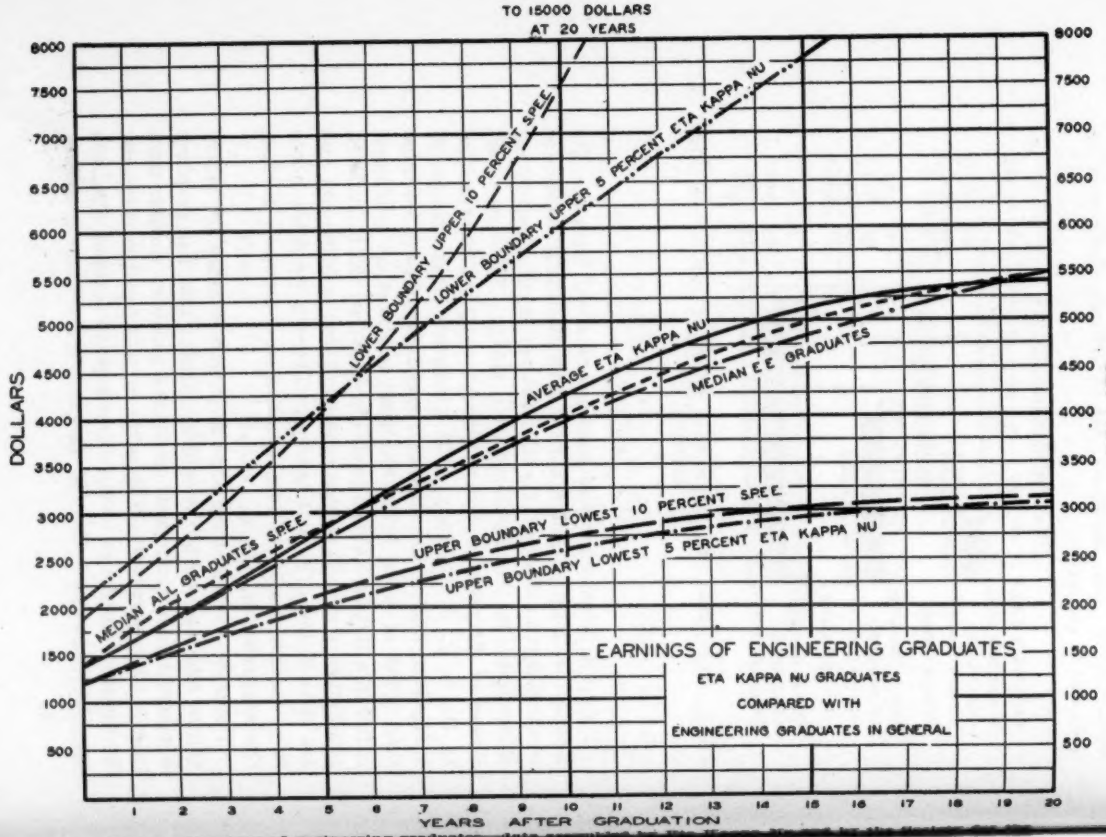

TO 15000 DOLLARS
AT 20 YEARS
LOWER BOUNDARY UPPER 10 PERCENT SPEE
LOWER BOUNDARY UPPER 5 PERCENT ETA KAPPA NU
AVERAGE ETA KAPPA NU
MEDIAN E E GRADUATES
MEDIAN ALL GRADUATES SPEE
UPPER BOUNDARY LOWEST 10 PERCENT SPEE
UPPER BOUNDARY LOWEST 5 PERCENT ETA KAPPA NU
EARNINGS OF ENGINEERING GRADUATES
ETA KAPPA NU GRADUATES
COMPARED WITH
ENGINEERING GRADUATES IN GENERAL
DOLLARS
YEARS AFTER GRADUATION

Fig. 9. Earnings of engineering graduates; data compiled by The Engineers Council for the Profession [illegible]

of the upper 10 per cent. of all cases. The lowest S. P. E. E. curve is the upper boundary of the lowest 10 per cent. The Eta Kappa Nu upper and lower curves similarly bound the upper and lower 5 per cent. of the cases. The three curves near the middle of the diagram show a very good agreement. If medians instead of averages had been used in the Eta Kappa Nu data, the agreement would probably have been even closer.

The minimum 10 per cent. curve of the S. P. E. E. study is quite close to the minimum 5 per cent. curve of the Eta Kappa Nu, showing twice as large a proportion of graduates in general below the line of small earnings. On the other hand the S. P. E. E. upper 10 per cent. curve exceeds the Eta Kappa Nu upper 5 per cent. curve. The spread of earnings among the Eta Kappa Nu men is strikingly smaller than that of all graduates. This may be due in part to the fact that such a large proportion of the Eta Kappa Nu alumni are employed by large industrial concerns. It should not be inferred that earnings constitute the only, or even the most important, criterion of success. Earnings are, however, more easily determined than other factors. A more valid indication would be the types of position and degrees of responsibility or some other such measure. It is impossible, however, to define these criteria with sufficient distinctness to reduce them to statistical form. Earnings themselves are, of course, a matter of direct importance and the data herein presented are believed to be of considerable value.

III. Values Assigned to Various Subjects and Groups of Subjects of the Electrical Engineering Curriculum.

The questionnaire on which these results are based provided for each man to indicate by a check mark whether he assigned *little, moderate* or *great* value to the various items listed. Space was also provided in which men who did not study some of the subjects could so indicate.

Figure 7 shows the relative importance assigned to the different divisions of the curriculum by men in electrical engineering, other engineering and non-engineering fields. Evidently the Eta Kappa Nu members believe in the importance of the fundamental sciences since over 80 per cent. of the replies assigned *great* value to them and only a negligible number assigned *little* value. English follows the science group very closely. Next in order are the electrical engineering courses proper; followed by economics, other engineering, and shop. Modern languages come last; about 63 per cent. of the men assigning little value to this study.

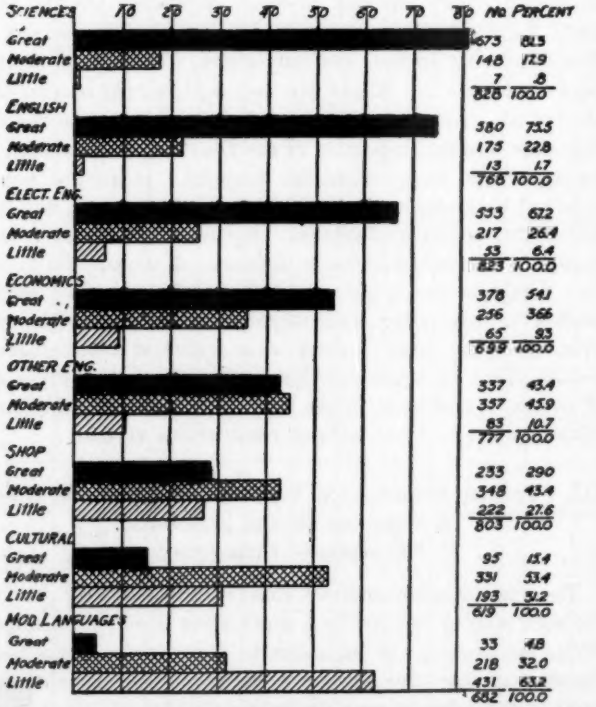


FIG. 7. Values assigned to various subjects or groups of subjects of the electrical engineering curriculum.

Some interesting differences are shown by the diagrams in the points of view of the men in various lines of activities as to the relative importance of these groups of subjects. All agree in the fundamental importance of the sciences and English. There is considerably more emphasis on the importance of the subject of economics among the men in other engineering and non-engineering groups than there is among the men in electrical engineering. There is also some difference of opinion as to the importance of cultural subjects, the men in electrical engineering holding these to be of somewhat less value than the men in other groups. As was to be expected, the electrical engineers assign greater importance to the electrical engineering subjects than do the other men. Similarly, the men in other engineering work assign greater importance to the other engineering subjects. All agree that shop work is of moderate importance though the non-engineers assign to it less value than do the engineers. The results on modern languages are in agreement with the results of other studies. It is to be noted that over one-sixth of the men did not study modern languages in college.

The relative importance, as shown by Figures 8*A* and 8*B*, assigned to the various subjects by men in different functional activities is interesting. As to English, there is substantial agreement on its fundamental importance. There is no dissent from the opinion that the sciences are of fundamental importance. All believe that cultural studies are of moderate importance. There is considerable divergence of opinion in the matter of economics and related subjects as shown by the following tabulation:

TABLE II.

	Percentage of Men Giving Replies Indicated.	
	Men in Work Primarily Technical.	Men in Work Primarily Administrative.
Little importance	17.8%	6.4%
Moderate importance	50.5%	23.2%
Great importance	26.7%	70.4%

Men in technical activities assign much greater value to the engineering subjects than do the men in administrative

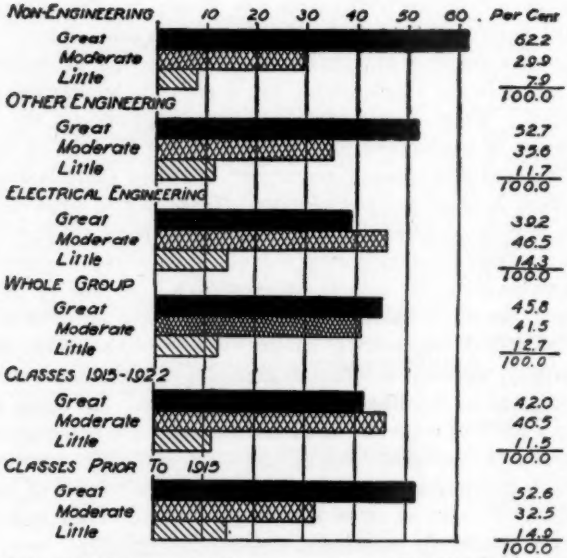


FIG. 8*A*. Need for more training in economics. Classification by groups.

activities. Shop is held to be of moderate importance by all groups.

IV. NEED FOR MORE TRAINING IN ECONOMICS.

The need for more training in economics in the college curriculum is felt to the following extents; little—12.7 per cent., moderate—41.5 per cent., great 46.9 per cent., these figures are the percentages of answers of the entire group of graduates under each of the designations. The older men indicated greater need than did the younger men, and to a well marked extent. The non-engineering group indicated the need materially more than did the others and graduates who are pursuing strictly electrical engineering work feel the need least. Similarly in the functional classification, the administrative group feel the need considerably more than the technical group. Figs. 8*A* and 8*B* present a condensed summary of these results.

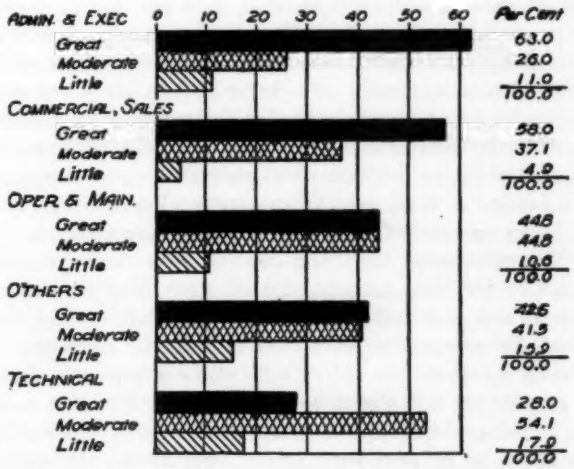


FIG. 8B. Need for more training in economics. Classification by functional activities.

V. DIVISIONS OF CURRICULUM TO BE REDUCED IN FAVOR OF ECONOMICS.

It should be understood that careful study is now being devoted to the time and emphasis to be given to economic studies in the engineering curriculum and that no final decision has been reached. If it is finally decided that more

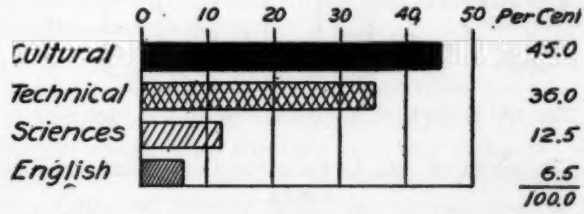


FIG. 9. Divisions of curricula to be revised in favor of additional economic training.

work of this character is desirable, it is obvious, in view of the present crowding of engineering curricula, that other parts of the curriculum must be reduced or the length of the course must be increased. The latter alternative is one which many believe to be undesirable for the majority of engineering students. Pending the final decision, opinions have been gathered as to the subjects which might be reduced with the least damage to make way for more extended economic training. The opinions of Eta Kappa Nu men are shown in Fig. 9. The curriculum has been divided into four principal groups of subjects, namely, the sciences, English, cultural subjects and technical engineering. Few believe that there should be any reduction in the sciences or English. The majority would reduce the cultural and engineering subjects. No answers to this question were given by 216 men and it may be inferred that they felt that no division of the curriculum could be reduced profitably. Apparently, the cultural subjects, exclusive of English, should be reduced to a greater extent than the technical engineering subjects. All groups of men, whether classified technically or functionally, are in close agreement on this matter.

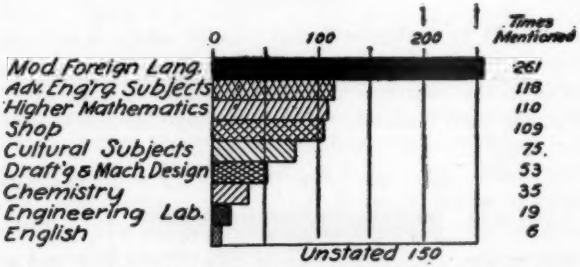


FIG. 10. Subjects of curriculum considered of least value.

VI. SUBJECTS OF THE CURRICULUM CONSIDERED OF LEAST VALUE.

In answering this question, provision was made for each individual to write in the name of the subject instead of

placing a check mark on a specified list, since it was desired to obtain spontaneous statements without suggestion. Fig. 10 shows a tabulation of the results. The table indicates the number of times each subject received mention.

In this list modern foreign languages lead by a considerable margin. These are followed by shop, advanced engineering subjects and higher mathematics, which were mentioned about an equal number of times. Only about 10 per cent. of the replies mentioned cultural subjects and still fewer mentioned other subjects. 150 men did not reply at all. Apparently there is only one subject of the engineering curriculum on which any substantial number of graduates agree as to its unimportance, namely, modern foreign languages. In this respect, the results of the Eta Kappa Nu study are quite in accord with all other similar inquiries. The Eta Kappa Nu results are also in agreement as to the importance of other subjects, since aside from foreign languages no other one subject is mentioned by any considerable proportion of graduates. In fact, quite a number of the men specificially state that in their opinion all subjects of the engineering curriculum are of sufficient value to warrant their retention. The conclusions are obvious. The problem of pruning any material from the engineering course without serious results is an extremely difficult one. Yet, at the same time there is great need felt for increasing the economic content and, as before stated, many feel that the engineering course should not be lengthened; at least that the age of graduation should not be greater that at present. The solution of this difficulty is by no means easy to find.

VII. Study Since Graduation.

The statement that an engineering education is not completed in college is so obviously true that it hardly needs support. The great majority of engineering graduates, in fact all who are properly ambitious, continue more or less systematically to pursue studies begun in college or to undertake study in new lines. In the opinion of the writer, sup-

ported by the view of many others, one of the greatest opportunities before American engineering colleges is the provision of means of advising or directing graduates in the continuation of their education. Not a few institutions are

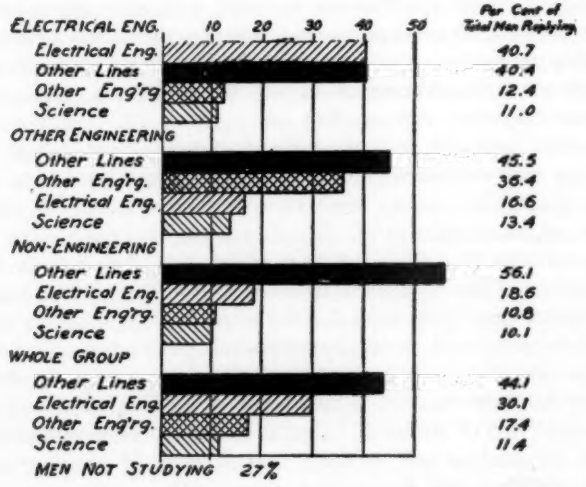


FIG. 11. Principal classes of subjects studied since graduation.

taking steps in this direction now and several have made excellent beginnings. Many large industrial firms recognizing the need of further training of engineering graduates have developed systematic post-scholastic courses which graduates enter upon leaving college. Certain of the correspondence schools, particularly those offering general business courses, enroll large numbers of technical graduates. The colleges, themselves, however, for the most part have as yet done little in the way of providing means to assist graduates in educational work after leaving college. To an even greater extent than graduates in general, Eta Kappa Nu men have systematically pursued one or more lines of study.

Figures 11, 12 and 13 give the data on which this statement is based. The figures indicate not only the number of replies mentioning each subject or group of subjects, but also the number of individuals who did not answer the question. It is to be noted that only about 20 per cent. of the entire number failed to indicate one or more subjects. As might have been expected, general business heads the list, followed closely by higher technical engineering. After a considerable gap, come pure sciences, cultural subjects, law, mathematics

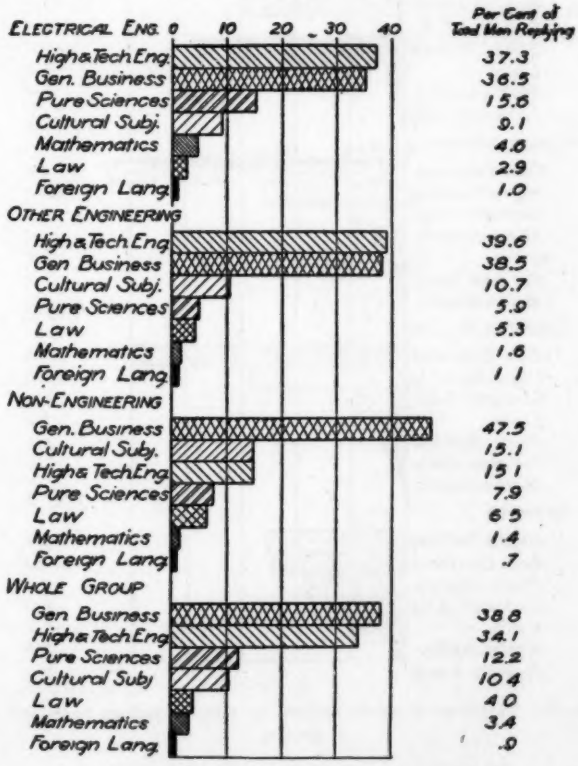


FIG. 12. Particular subjects studied since graduation.

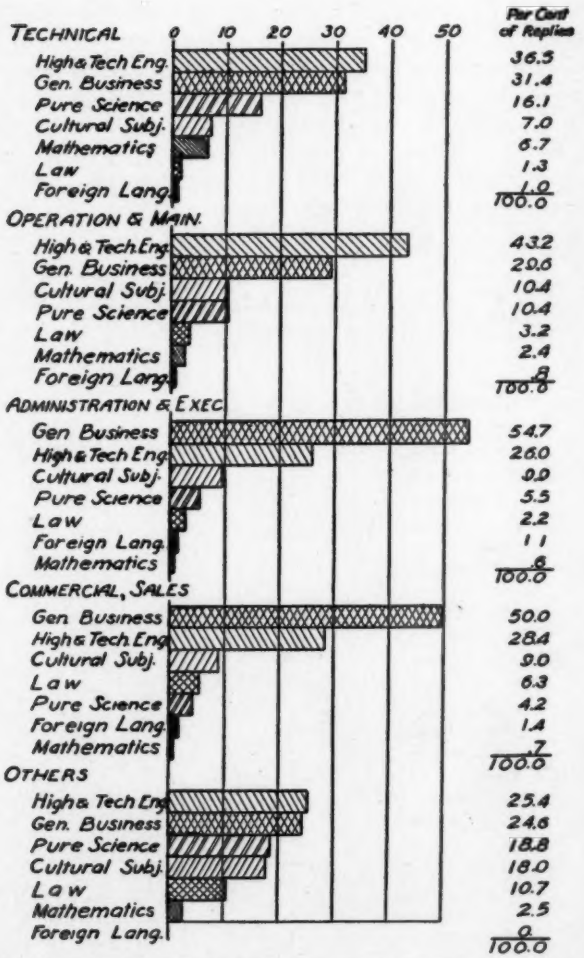


FIG. 13. Particular subjects studied by men in various functional activities.

and languages. These data are valuable aids to the colleges in establishing post-scholastic educational programs and it is to be hoped that more general provision for such work among the graduates will be made in the near future.

In conclusion, the writer wishes to express appreciation to Eta Kappa Nu for its contribution to the study of engineering education. The results are valuable not only as compilations of statistics but in many other ways which cannot be mentioned specificially within the limits of this article.

The study is still in progress. Upon its completion, it is hoped that constructive measures for the betterment of engineering education will be instituted.

EVOLUTIONARY TRENDS IN ENGINEERING CURRICULA.

BY W. E. WICKENDEN,

Director of Investigation.

The accompanying diagrams indicate some of the general trends in the evolution of engineering curricula during the past fifty years. They are based on the time or credit assignments in the various subjects as shown by the catalogs of a group of representative institutions taken at intervals of fifteen years from 1870 to 1915 and for the academic year 1923–'24. The institutions included in the averages are Alabama Polytechnic, Case, Cornell, Illinois, Iowa State College, Lehigh, Massachusetts Institute of Technology, Michigan, Purdue and Wisconsin.

The first series of four diagrams shows the trends in particular curricula by dividing the requirements into thirteen groups and arranging these from the botton upward in the order of increasing specialization. A reference line is drawn horizontally so as to separate the subjects which are special to engineering curricula from those included in general collegiate education. Restricted electives have been divided pro rata among the subjects specified. Free electives are shown just above the line of reference since they may be chosen from the technical groups. But for the element of confusion which would be introduced it would be appropriate to draw the reference line through the middle of this item. The diagrams are so arranged that a trend toward increased specialization is shown as an upward displacement. The unit of measure in all diagrams is the complete work of a normal academic year.

It is apparent that the general tendency since 1870 has been toward greater specialization, but this movement appears to have passed its peak and begun to recede in the fields of civil and mining engineering. It is natural to inquire

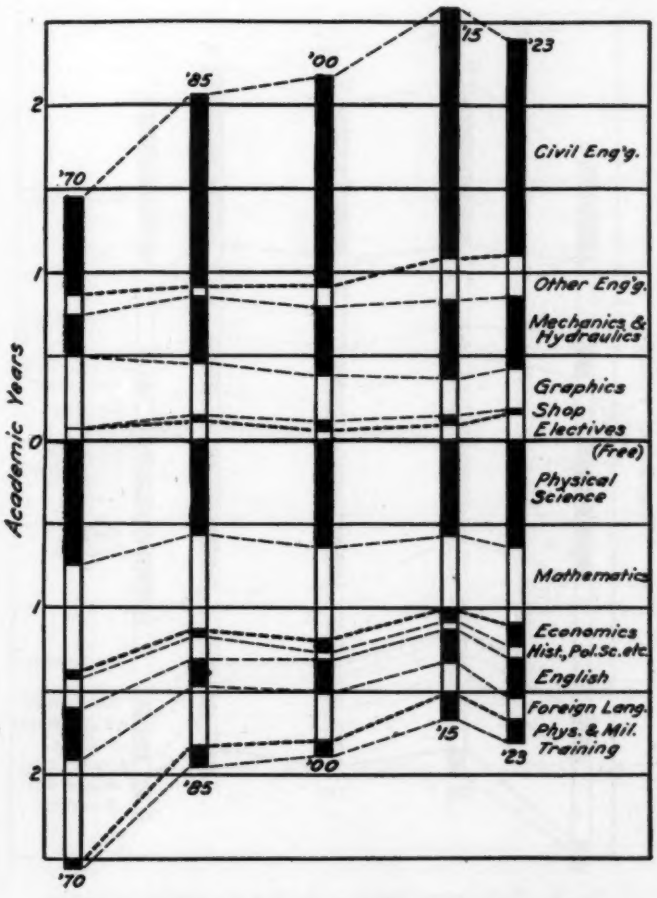


FIG. 1. Evolutionary trends in civil engineering curricula.

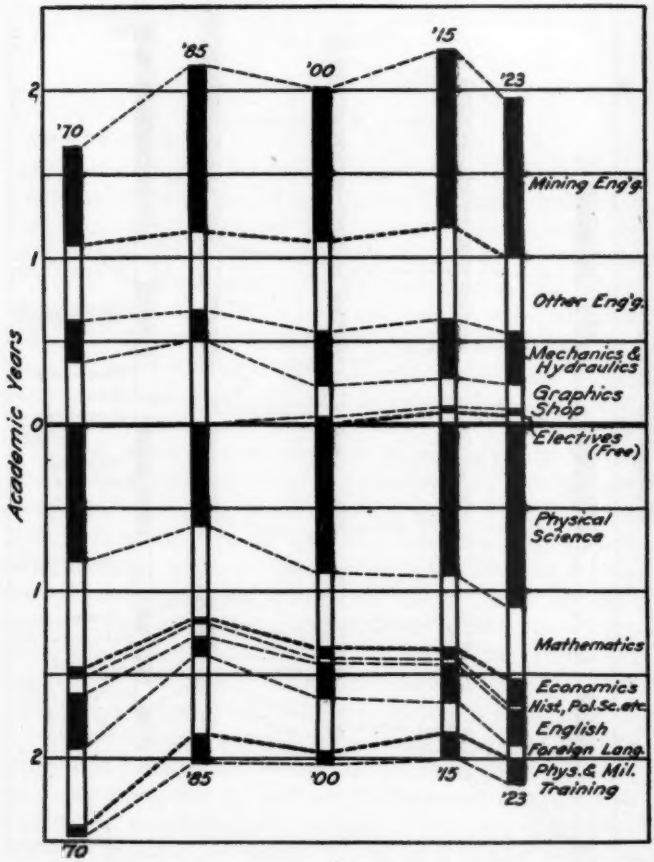


FIG. 2. Evolutionary trends in mining engineering curricula.

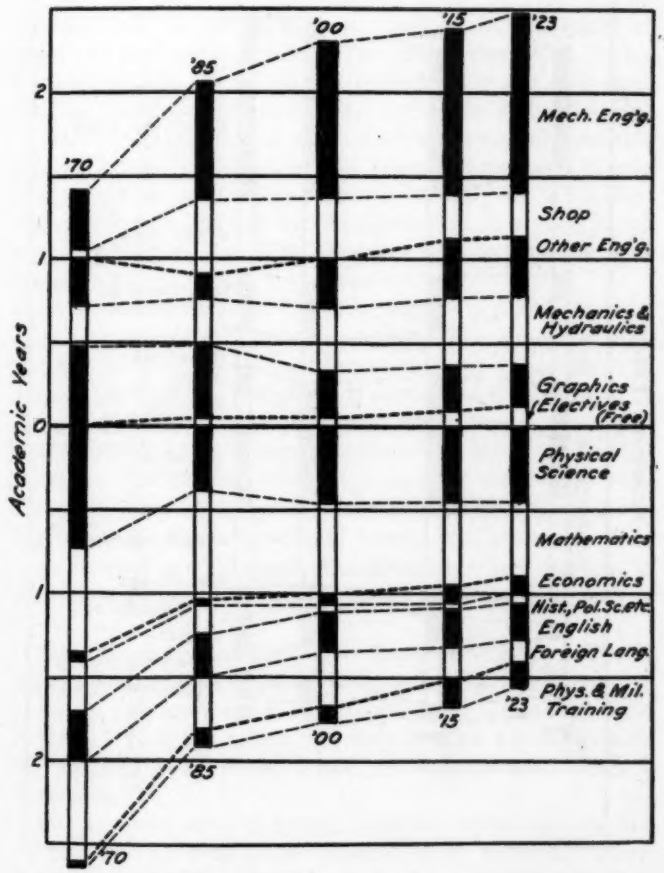


FIG. 3. Evolutionary trends in mechanical engineering curricula.

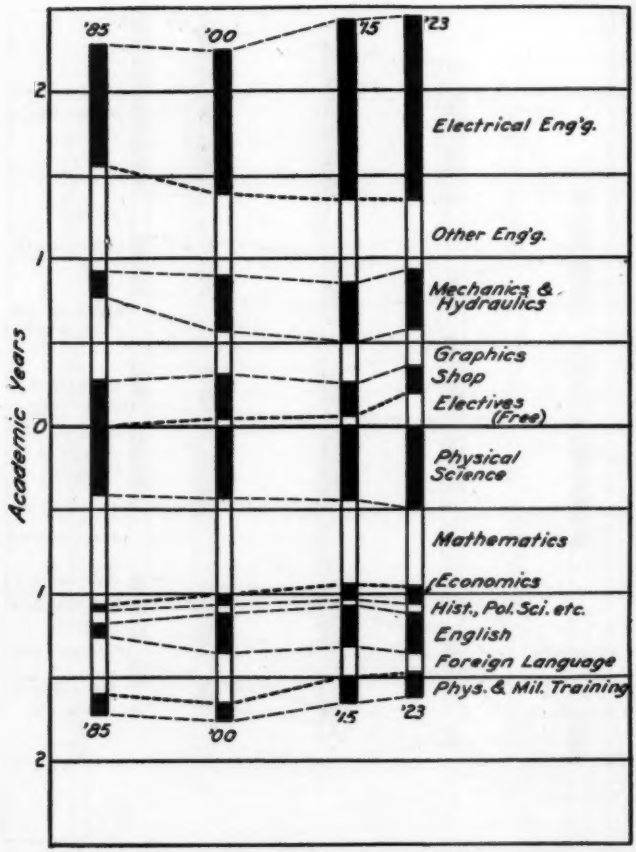


FIG. 4. Evolutionary trends in electrical engineering curricula.

whether the relatively small technical content in the curricula of 1870 was due to the enthusiasm of the fathers for general culture or to the paucity of well-organized teaching material from the engineering realm. The indications point in the latter direction. In the interim between 1870 and 1900 engineering curricula evolved rapidly from their earlier form as moderate variants to the then existing scheme of scientific education into a distinctive and characteristic type. Probably the most outstanding influence in shaping this evolution was the prolific and notable authorship of a small group of men of whom Mansfield Merriman was perhaps the most conspicuous example.

In the second series of diagrams, Figs. 5 to 8 inclusive, the trends are shown with reference to particular groups of subject matter. To aid comparisons, the content of each item in the several curricula considered is shown as a distinct band in the group for each reference year. Fig. 5 shows plainly the diminishing linguistic requirements. The battle of foreign language requirements has been a steadily losing fight over the entire period. This trend is evident in mining engineering where the business value of foreign languages has often been stressed and in chemical engineering where German is often regarded as having an exceptional tool value, as well as in the other branches.

The requirements in English, at first generous, later showed a tendency to fluctuate under the pressure of the fast rising technical requirements, then to become stabilized and gain strength. It is plain, however, that English has fallen heir to relatively little of the estate of the deceased foreign languages.

In the social science group, however, economics has obviously been growing at the expense of its kindred. There is nothing to indicate that economics has ever been regarded as a foundation subject by the designers of engineering curricula. Both the time assignment and the content of the subject have marked it as a collateral rather than an integral part of the engineer's professional training. With the broader conception of the engineer's function in industry

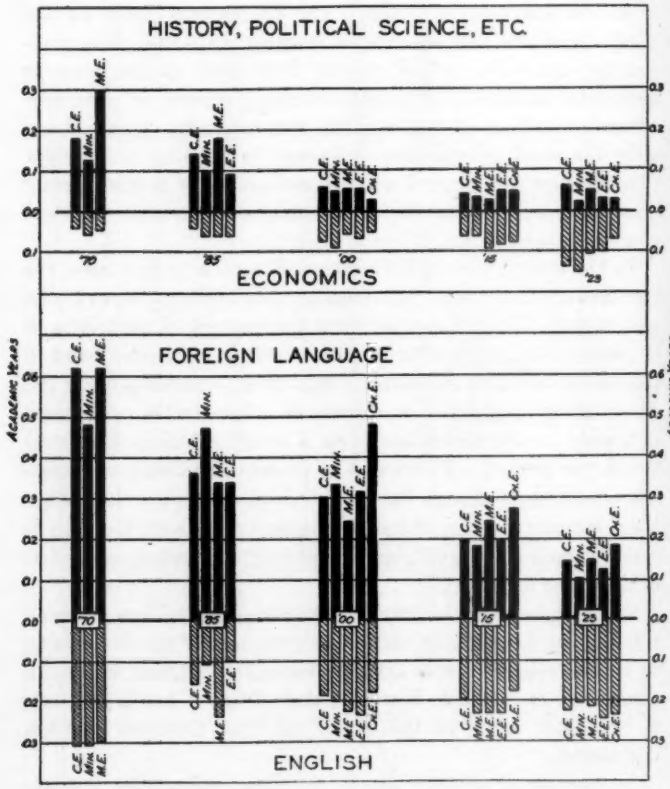


FIG. 5. Evolutionary trends in language and social science content.

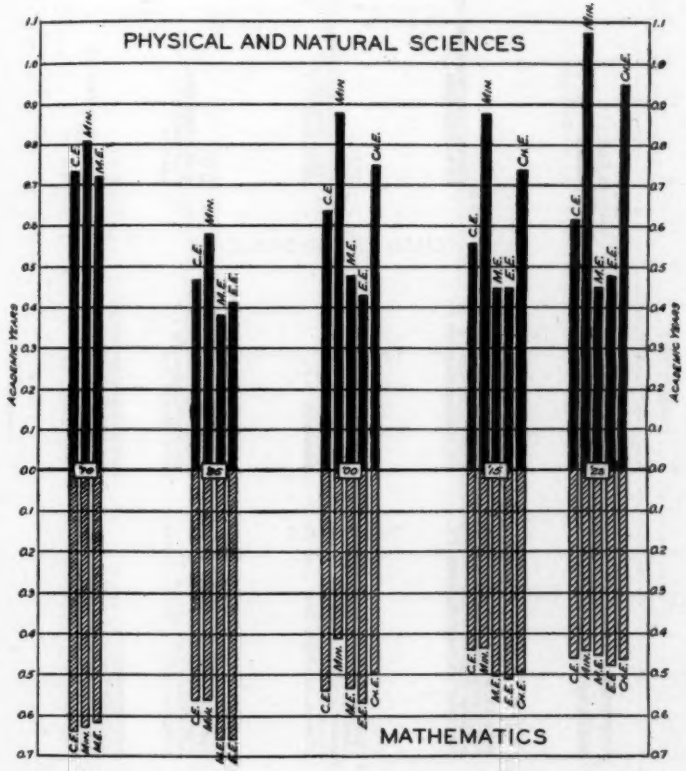


FIG. 6. Evolutionary trends in mathematics and science requirements.

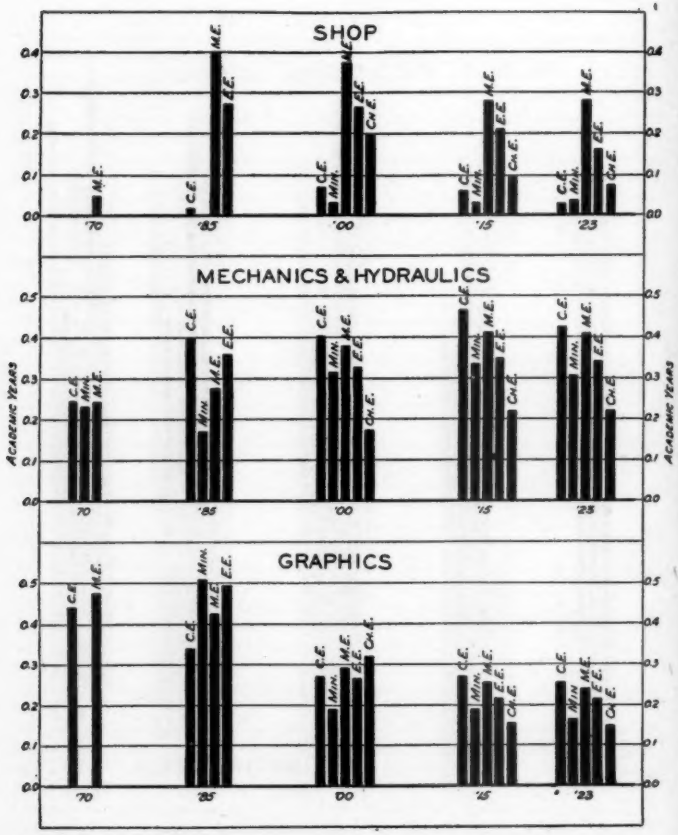


FIG. 7. Evolutionary trends in general technical subjects.

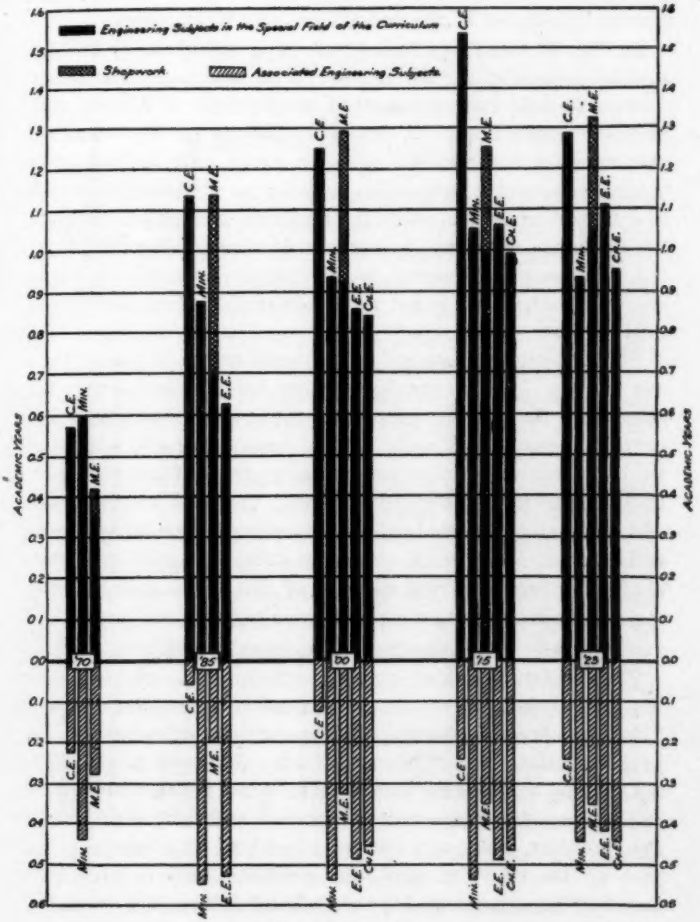


FIG. 8. Evolutionary trends in engineering subjects proper.

and public life which is coming to prevail a new attitude toward this aspect of the curriculum may be expected.

In Fig. 6. there are indications of a reduction in mathematical content and of an increase in the sciences. The latter feature is most strongly marked in the field of mining and chemical engineering. A complete picture of the trend of mathematical requirements could be gotten only by including the requirements for admission, which have doubtless increased in sufficient amount to offset the apparent shrinkage. In view of the doubts expressed by many engineering educators as to the effectiveness of present-day instruction in mathematics in secondary schools, it is not wholly clear that mathematics has held its own.

The underlying technical subjects are traced in greater detail in Fig. 7. The graphics group has declined markedly since 1885 and has not yet shown evidence of fixation or recovery of ground. Possibly these changes are offset in part by the progressive incorporation of material from this field into the engineering subjects proper. The work in mechanics and hydraulics has gradually advanced to a state of apparent stabilization. Shopwork, evidently developed with great enthusiasm during the last quarter of the recent century, has since been much reduced and is now holding its ground effectively only in the mechanical engineering field.

The chief evidences of increased specialization are shown in Fig. 8, which relates to the engineering subjects proper. There has been a greater tendency to particularize than to broaden within the engineering field. Attempts to popularize general engineering curricula have not prospered largely in the face of this movement. In civil and mining engineering, however, there are recent indications of a tendency to give up the effort to equip the graduate with an all-round technical knowledge of his professional field and to broaden other elements of the curriculum.

It is not for the writer to predict what the next chapter in this evolutionary process will be. The present investigation which the Society is making through its many coöperative efforts is intended to assemble the evidence which may serve to guide the colleges in writing the next chapter.

ENGINEERING DEGREES.

BY H. P. HAMMOND,

Associate Director of Investigation.

The questions of what degrees should be conferred upon completion of the undergraduate engineering curriculum and upon what basis advanced and professional degrees should be conferred have been under frequent discussion since the foundation of the Society in 1893. A study of the volumes of *Proceedings* will reward anyone interested in the subject; particularly those for 1895, 1906, 1910, 1918, and 1920.

Such a study of the records leads to two general conclusions: first that there is pretty general agreement among the *individual members* of the Society that uniformity in degree practices is desirable, and second that a considerable proportion of the *institutions* are not inclined to abandon existing practices, many of which are of long standing, in order to conform to those of the majority.

The question is therefore still an open one. The problem was recognized as one to which attention should be given in connection with the present Investigation of Engineering Education and a study of the past and present situation has therefore been made. Valuable assistance has been rendered by the faculty committees of Lehigh University and the Missouri School of Mines. The present article gives a condensed summary of the results. Its purpose is merely to give the facts and to call attention to recommendations which have been submitted to the Society in the past and the effects which such recommendations have had.

In preparing the tabulations of present practices (for the year 1925) information regarding 150 institutions has been compiled from catalogues and verified by correspondence or otherwise in the many cases wherein catalogue statements are not entirely clear. Data given in the Society's *Proceedings*

have been used for years other than 1925. It is apparent that the earlier tabulations did not include all of the degree-granting institutions. It is possible that complete tabulations for the earlier years would change somewhat the relative proportions of institutions conferring the several degrees, but it is probable that the general tendencies are shown fairly accurately, since the lists include a good representation of different classes of institutions.

It will be noted that the tabulations list the various degrees as "B.S. in C.E.," "B.C.E.," "C.E.," etc. This was done in preference to using the more general designations applying to all courses, such as "Bachelor of Science with Designation," in order to use the specific titles and to make possible the inclusion of minor modifications of the manner in which the designations are stated. When the degree is entered as "B.S. in C.E." it should, therefore, be understood to include all similar degrees in other courses, such as B.S. in M.E., B.S. inE.E., B.S. in E.M., etc. Institutions which do not offer civil engineering curricula have been included in the tabulations and their degrees listed with the corresponding civil engineering degrees. A few institutions offer different undergraduate programs leading to different types of degrees. One college, for example, offers one program leading to the degree Bachelor of Science in Civil Engineering, and another program of the same duration, but somewhat different content, leading to the degree Civil Engineer. Another college once offered the degree Civil Engineer in one curriculum and the degree Bachelor of Mechanical Engineering in another curriculum. In such cases both (or all) of the degrees offered as first degrees have been included. The tabulations therefore show a greater number of degree practices than of institutions. Second or post-graduate degrees have been treated separately.

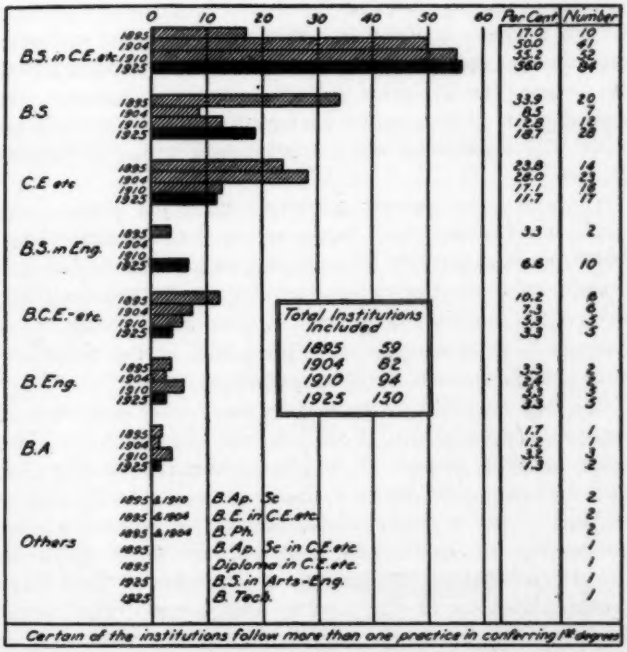
First Degrees.

Table I shows practices relating to first degrees in engineering which have been in effect at four different periods in the

past thirty years. Variations in length or type of curricula have not been included but only variations in the several degrees themselves. The lengths of the horizontal bars in-

TABLE I.

PAST AND PRESENT PRACTICES RELATING TO FIRST DEGREES IN ENGINEERING.



dicate graphically the proportions of institutions conferring the various degrees. In tabulating the data it was necessary to group together a number of minor modifications of designations, such as "B.S. in C.E.," "B.S. for C.E.," and the like since the older tabulations were prepared in that manner. The entire range of diversity of practice, therefore, is not shown.

It is clear, however, that there is considerable diversity in practice in conferring first degrees. No fewer than nine distinctly different degrees conferred at present are included in the list. In some cases differences in practice may be based upon differences in the nature of the curriculum. An institution which offers curricula in civil, mechanical, electrical and chemical engineering, for example, with little differentiation between them, may feel that the degree Bachelor of Engineering, or Bachelor of Science in Engineering is more appropriate than the degree Bachelor of Science with designation of the course. In the great majority of cases, however, the several types of degrees are conferred in curricula which are essentially similar and which might properly lead to the same degree.

There is quite general agreement upon the propriety of conferring the bachelor's degree rather than the professional degree upon completion of an undergraduate curriculum and a majority of the institutions evidently prefer the particular designation Bachelor of Science in Civil Engineering. This practice is in accordance with the action of the Society in 1910 to which reference will be made later.

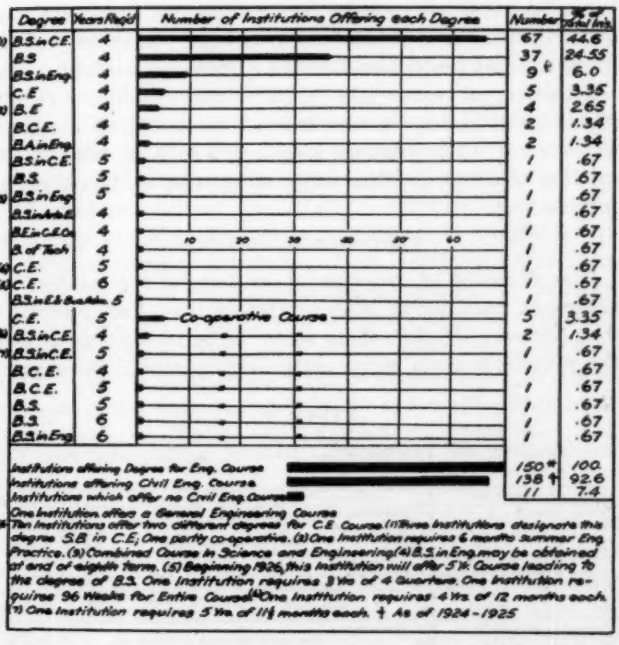
The order in which the several degrees appear in the tabulation is the same as that of the numbers of institutions which confer them at present. It will be noted that somewhat more than half confer the degree Bachelor of Science in Civil Engineering. Next in order comes Bachelor of Science without designation of curriculum, followed by Civil Engineer, Bachelor of Science in Engineering, Bachelor of Civil Engineering, Bachelor of Engineering and others. The degree Bachelor of Technology is new with the present year as far as the writer is aware.

It is interesting to trace the course of practice and to read the discussions in the Society's *Proceedings* relative to conferring the professional degree in engineering as a first degree. Of the fourteen institutions which are listed in the tabulation of 1895 as following this practice, but five have continued it to the present time. The others of the original

group now give the bachelor's degree in one form or another. It is understood that one other of the original group has taken steps to change its practice in the immediate future. There have, however, been additions to the list since 1895 and there are now seventeen institutions which confer professional degrees as first degrees. Of the seventeen, six offer coöperative courses of five or more years' duration; two confer the degree

TABLE II.

FIRST DEGREES AND GRADUATION REQUIREMENTS IN CIVIL ENGINEERING IN 1925.


Degree
Years Req'd
Number of Institutions Offering each Degree
Number
% of total Inst.
B.S. in C.E. 4 67 44.6
B.S. 4 37 24.55
B.S. in Eng. 4 9 † 6.0
C.E. 4 5 3.35
(2) B.E. 4 4 2.65
B.C.E. 4 2 1.34
B.A. in Eng. 4 2 1.34
B.S. in C.E. 5 1 .67
B.S. 5 1 .67
(3) B.S. in Eng. 5 1 .67
B.S. in Arch. E. 4 1 .67
B.E. in C.E. Co. 4 1 .67
B. of Tech. 4 1 .67
(4) C.E. 5 1 .67
(4) C.E. 6 1 .67
B.S. in E. & Arch. 5 1 .67
C.E. 5 5 3.35
(5) B.S. in C.E. 4 2 1.34
(5) B.S. in C.E. 5 1 .67
B.C.E. 4 1 .67
B.C.E. 5 1 .67
B.S. 5 1 .67
B.S. 6 1 .67
B.S. in Eng. 6 1 .67
10 20 30 40 50 60
Co-operative Course
Institutions offering Degree for Eng. Course 150* 100.
Institutions offering Civil Eng. Course 138 † 92.6
Institutions which offer no Civil Eng. Course 11 7.4

One Institution offers a General Engineering Course

*Ten Institutions offer two different degrees for C.E. Course. (1) Three Institutions designate this degree S.B. in C.E.; One partly co-operative. (3) One Institution requires 6 months summer Eng. Practice. (3) Combined Course in Science and Engineering. (4) B.S. in Eng. may be obtained at end of eighth term. (5) Beginning 1926, this Institution will offer 5 Yr. Course leading to the degree of B.S. One Institution requires 3 Yrs. of 4 Quarters. One Institution requires 96 Weeks for Entire Course. (6) One Institution requires 4 Yrs. of 12 months each. (7) One Institution requires 5 Yrs. of 11½ months each. † As of 1924-1925

upon completion of full-time residence courses of five or more years' duration; one has changed from the degree Bachelor of Science in Engineering to the degree Civil Engineer, one

did not offer engineering curricula in 1895; and two, though not included in the 1895 tabulation, probably conferred the professional degree at that time. It may be worth noting that of the 8,569 first degrees conferred by the 150 colleges in 1925, 1,037 were professional degrees.

Table II has been included to indicate the diversity of practice in awarding first degrees in engineering, both as to designation of the degree and as to the duration and types of curricula. Civil engineering curricula only are included. It will be noted that there are no fewer than twenty-four different variations of practices or requirements. The table is not intended in any sense as a criticism of the diversity of types of programs—quite the contrary—but merely to indicate the fact that many different degrees are conferred upon satisfaction of essentially similar requirements. This is shown quite clearly in the case of the coöperative courses wherein are eight different degree practices in effect in the thirteen institutions which offer coöperative curricula in civil engineering.

Professional Degrees.

The diversity of practice in conferring the professional degree in engineering is even greater than that relative to first degrees. In fact there seems to be no agreement as to the *principles* upon which such degrees should be granted.

TABLE III.

Requirements for Professional Degrees in Engineering in 1925.

Requirements	Institutions Specifying Each Requirement	Number	Per Cent of Institutions
3 Years Practice	Practice (In Absentia)	31	20.3
5 " "		15	10.0
4 " "		14	9.3
2 " "		8	5.3
7 " "		1	0.6
1 Yr. in Residence + 1 Yr. Practice	Post-graduate Study in Residence + Practice	2	1.3
1 " " + 2 Yrs. "		1	0.6
1 " " + 4 Yrs. "		1	0.8
1 Yr. Post-graduate Study	Post-graduate Study in Residence	14	9.3
2 Yrs. " " "		3	2.0
4 Yrs. Undergraduate Study	Undergraduate Study	9	6.0
5 Yrs. Co-operative		6	4.0
5 or 6 Yrs. in Residence		2	1.3
No Published Provision		49	32.6

Many Institutions do not definitely state requirement for Thesis

150 Institutions included; 6 have optional requirements.

Table III is a summary of present practices. It will be noted that forty nine institutions have no published provisions whatever; that sixty-nine confer the degree upon the basis of practical experience, with or without requirement of a thesis; four upon the basis of both post-graduate study in residence and practical experience; seventeen upon the basis of post-graduate study in residence only; and seventeen upon the basis of undergraduate curricula only. Of the one hundred and one institutions which have published provisions for the award of the professional degree, seventy-three, or approximately three-quarters, evidently believe that demonstrated inclination and fitness to follow engineering as a vocation after graduation constitute a necessary part of the requirement. This point has been frequently stressed in the discussions at the Society's meetings.

It is apparent that a considerable number of colleges believe that academic institutions should confer degrees for work in course only. It may be this belief possibly coupled with the feeling that an engineer can not be qualified for the responsible practice of his profession by a college course alone which has deterred so many institutions from making any provision whatever for conferring the professional degree. A majority of the institutions, however, seem to believe that the title Civil Engineer has a legitimate place among professional men and that it is the function of the colleges to confer it. As above stated, however, there seems to be no agreement either as to the principles or the specific requirements upon which the degree should be conferred.

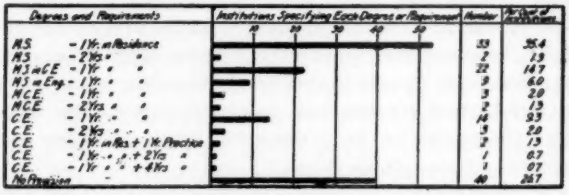
Advanced Degrees in Course.

Table IV shows the present practices of the colleges in relation to advanced degrees in engineering conferred for work in course. It will be noted that forty institutions make no provision for post-graduate engineering curricula. Of the one hundred and ten which do, one half confer the degree Master of Science without designation of curriculum. The remaining half confer either Master of Science with designa-

tion of curriculum or the professional degree. Four institutions confer the professional degree on a basis of post-graduate study in residence plus practical experience. The diversity of practice in conferring advanced degrees is quite as great as in conferring first degrees.

TABLE IV.

SECOND DEGREES IN ENGINEERING AND REQUIREMENTS THEREFOR IN 1925.


Degrees and Requirements
Institutions Specifying Each Degree or Requirement
Number
Per Cent of Institutions
10
20
30
40
50
M.S. - 1 Yr. in Residence
M.S. - 2 Yrs. " "
M.S. in C.E. - 1 Yr. " "
M.S. in Eng. - 1 Yr. " "
M.C.E. - 1 Yr. " "
M.C.E. - 2 Yrs. " "
C.E. - 1 Yr. " "
C.E. - 2 Yrs. " "
C.E. - 1 Yr. in Res. + 1 Yr. Practice
C.E. - 1 Yr. " " + 2 Yrs. "
C.E. - 1 Yr. " " + 4 Yrs. "
No Practice -

RECOMMENDATIONS RELATING TO DEGREES.

The most concrete recommendation to the Society in the matter of degrees was presented by a special committee at the annual meeting of 1910. This was based upon an analysis of the then existing situation and presented explicit recommendations as to the basis upon which the several degrees should be conferred. The complete report of the committee will be found on pages 135 et seq. of Vol. XVIII of the Society's *Proceedings*. The principal recommendations with reference to first degrees, advanced degrees, and professional degrees are repeated here to indicate the extent of agreement with them of past and present practices.

"I. A four-year engineering course should normally lead to the degree Bachelor of Science (B.S.), to which should be added a specifying phrase, as for example, Bachelor of Science in Civil Engineering."

"IV. One year of resident work in graduate engineering and scientific subjects by a Bachelor of Science in Engineering should normally lead to the degree Master of Science (M.S.) with the specifying phrase, as, for example, Master of Science in Civil Engineering."

"VI. The professional engineering degrees, C.E., M.E., etc.,

should be given only to graduates who present satisfactory evidence of professional work of superior quality extending over not less than three years, and who submit a satisfactory thesis."

It will be noted for a study of the preceding tabulations that more of the colleges adhere to recommendations I and VI of this report than to any other one practice; in fact this was the case at the time the report was presented. Only a minority, however, follow recommendation IV. Since the submission of the report there has been some tendency toward the adoption of its recommendations though there is still far from that uniformity which the committee (and apparently the Society membership) evidently believed to be desirable.

The present article is written in the hope that the matter of degree practices will be given further study by the faculties, since it seems clear that present conditions are less satisfactory than in other branches of education for the professions.

PROGRAM OF THE 34th ANNUAL MEETING, STATE UNIVERSITY OF IOWA, IOWA CITY, JUNE 16–18, 1926.

WEDNESDAY, JUNE 16, 1926.

10:00 A.M. Joint Meeting of the Division of Deans and Administrative Officers and Teachers of English. Old Capitol.

J. Raleigh Nelson, presiding.

12:30 P.M. Luncheon Meeting of the Council, Memorial Union.

2:00 P.M. Opening Session, Chemistry Building, George B. Pegram, President, presiding.

Address of Welcome, Walter A. Jessup, President, The Iowa State University.

Response: George B. Pegram, President of the Society.

Reports of Collateral Studies Relating to the Investigation of Engineering Education:

Studies Conducted by the Founder Societies:

Anson Marston, Chairman, Special Committee, American Society of Civil Engineers.

Studies Conducted by the National Industrial Conference Board: Magnus W. Alexander, President.

Extension Courses in Engineering:

C. M. Jansky, University of Wisconsin.

Discussion.

Reports of Faculty Committees:

University of Michigan Committee:

W. E. Hoad.

University of Washington Committee:
E. R. Wilcox.
Lehigh University Committee: F. V. Larkin.
Iowa State College Committee: A. H. Fuller.
Discussion.
Appointment of Committees.

8:00 P.M. General good-fellowship meeting in the Memorial Union.

THURSDAY, JUNE 17, 1926.

7:30 A.M. Breakfast Meeting of the Council. Memorial Union.

9:30 A.M. Second Session, Chemistry Building, George B. Pegram, President, presiding.
Reports of Investigative Committees of the Society:
Committee on Students and Graduates:
R. L. Sackett, Chairman.
Committee on Admissions and Eliminations:
H. H. Jordan, Chairman.
Committee on Teaching Personnel:
C. H. Warren, Chairman.
Committee on Services, Facilities and Costs:
Harold Pender, Chairman.
Committee on Coöperative Courses:
Erich Hausmann, Chairman.
Committee on Economic Content of Engineering Education:
H. E. Riggs, Chairman.
Discussion.

2:00 P.M. Third Session, Chemistry Building, George B. Pegram, President, presiding.
Reports on Special Studies Relating to the Investigation of Engineering Education:

Results of the Iowa Placement Examinations, George D. Stoddard, State University of Iowa.

Studies of Engineering Curricula, Walton C. John, United States Bureau of Education.

Summary of Fact-Gathering Stages of the Investigation of Engineering Education:

H. P. Hammond, Associate Director of Investigations.

Discussion.

Report of the Nominating Committee.

7:00 P.M. Annual Dinner, Memorial Union, H. V. Carpenter, Vice President, presiding.

Presidential Address: Surveys of Higher Education:

George B. Pegram, Dean, Schools of Mines, Engineering and Chemistry, Columbia University.

Dancing and Social Hour.

FRIDAY, JUNE 18, 1926.

7:30 A.M. Breakfast Meeting of the Council, Memorial Union.

9:00 A.M. Fourth Session, Chemistry Building, F. P. McKibben, Vice President, presiding.

Report of the Treasurer.

Report of the Secretary.

Reports of Committees.

Report of the Board of Investigation and Coördination; Charles F. Scott, Chairman,
W. E. Wiekenden, Director of Investigations.

Discussion.

12:30 P.M. Luncheon Meeting, Division of Deans and Administrative Officers, Memorial Union.
H. S. Boardman, Chairman.

Luncheon Meeting, Teachers of English.
J. Raleigh Nelson, Chairman.

1:00 P.M. Conference of Teachers of Drawing and Design, Room 103N, Engineering Building. Topic: "Drafting Standards."

Thos. E. French, Chairman.

2:30 P.M. Fifth Session, Chemistry Building, George B. Pegram, President, presiding.

General Discussion of the Report of the Board of Investigation and Coördination.

Registration and Information.

Registration and Headquarters for the convention well be in the Chemistry Building of the University.

Rooms.

Dormitories and Private Houses.

It is expected that many members who are not accompanied by their wives will find it convenient to room at the "Quadrangle"—University dormitory for men. At least twenty-five single rooms and a hundred double rooms will be available. In each room there is a lavatory with hot and cold running water, and a telephone connected with the city switchboard. Double rooms have two single beds. There are no private bath rooms. General toilet rooms are equipped with showers. There is a commodious lounge for the use of guests. The Quadrangle is about ten minutes walk from the buildings where the meetings will be held. A charge of $1.00 per day for each person will be made for rooms in the dormitory.

For men accompanied by their wives at least one of the annexes to the women's dormitory will be available. Charges for rooms will be $1.00 per day for each person.

Rooms in private houses will also be available at reasonable rates.

Reservations for rooms in the Quadrangle, women's dormitory annex, or private houses, should be made through the chairman of the housing committee. Address R. B. Kittredge,

630 S. Governor St., Iowa City, Iowa. It is requested that each member making a reservation for a room in the Quadrangle state whether or not he is willing to share a double room with another member.

Hotels.

Hotel accommodations in Iowa City are limited and those members who prefer to room at hotels are urged to make their reservations early and to make them directly with the hotel. The leading hotels, with their room rates, are as follows:

Hotel Jefferson, Washington and Dubuque Sts. 85 rooms, 35 rooms probably available.

Rooms for 1 person, without bath.....$1.50–$2.50
With bath.....$3.00
Rooms for 2 persons, without bath.....$2.50–$3.00
With bath.....$5.00

Of the rooms for two persons, eight of those with bath have twin beds. Each of the others has one double bed.

Burkley Hotel, Washington and Capitol Sts. 65 rooms. 30 to 35 rooms probably available.

Rooms for 1 person, without bath.....$1.25–$1.50
With bath.....$2.00–$2.25
Rooms for 2 persons, without bath.....$2.50
With bath.....$3.00–$3.50

Each of the rooms for two persons has one double bed.

Hotel Washington, Washington and Gilbert Sts. 45 rooms. 20 rooms probably available.

Rooms for 1 person, without bath.....$1.50
With bath.....$2.50
Rooms for 2 persons, without bath.....$3.00
With bath.....$4.00

About half of the rooms for two persons have twin beds. Each of the others has one double bed.

MEALS.

Meals may be had at reasonable rates at a number of conveniently located places. Of the hotels only the Jefferson

serves meals. A canteen, for the service of light lunches, will be open at the Quadrangle. There is a cafeteria in the Memorial Union open to men and women.

Camping.

Members who come by automobile and desire to camp will find excellent facilities in The City Park, with water and campstoves available. No charge is made for camp sites. The Park is about a mile from the meeting place.

Train Reservations.

Visitors desiring train reservations for their departure should make this known at the Headquarters at the time of registration.

Time and Meeting Places.

Iowa City uses *central standard time.*

General meetings of the society will be held in the Chemistry Building of the University.

Meetings of the Council will be held in the Memorial Union.

Conferences of teachers of English and the general conference of the Division of Deans and Administration Officers and Teachers of English will be held in the Old Capitol.

There are ladies' rest rooms in practically all University buildings.

Entertainment.

While the convention is in session, the Ladies' Committee will provide automobile trips, teas, and other entertainment for visiting ladies. A program will be furnished at the time of registration.

Mail should be addressed to the S. P. E. E. Headquarters, Chemistry Building, Iowa City, Iowa.

Golf links and tennis courts are available.

Representatives of the Transportation Committee will meet trains and interurban cars. Visitors who arrive by motor or are missed by the committee should report to the Registration Headquarters in the Chemistry Building.

Local Committees.

General.

Wm G. Raymond
T. G. Caywood
B. P. Fleming
A. H. Ford
F. G. Higbee
G. J. Keller
R. B. Kittredge
B. J. Lambert
F. A. Nagler
S. M. Woodward

Registration.

A. H. Ford
Thos. Matthews
J. R. Eyre
John Fielding

Housing.

R. B. Kittredge
A. H. Holt

Reception and Transportation.

G. J. Keller
H. L. Rietz
A. V. O'Brien
K. H. Ekstrand
Joseph Kusick
F. P. Schone

Information.

T. G. Caywood
F. E. Holmes
H. C. Thompson

Entertainment.

B. J. Lambert
F. A. Nagler
E. L. Waterman

Dinner.

F. G. Higbee
A. W. Volkmer

Publicity and Printing.

F. A. Nagler
Carl Menzer

Meetings.

B. P. Fleming
Edw. Bartow
G. W. Stewart

Finance.

S. M. Woodward
D. D. Curtis
I. H. Prageman

Ladies.

Mrs. B. J. Lambert
Mrs. Edw. Bartow
Mrs. T. G. Caywood
Mrs. D. D. Curtis
Mrs. K. H. Ekstrand
Mrs. J. R. Eyre
Mrs. John Fielding
Mrs. B. P. Fleming
Mrs. A. H. Ford
Mrs. F. G. Higbee
Mrs. F. E. Holmes
Mrs. A. H. Holt
Mrs. G. J. Keller
Mrs. R. B. Kittredge
Mrs. Joseph Kusiek
Mrs. F. A. Nagler
Mrs. A. V. O'Brien
Mrs. W. G. Raymond
Mrs. F. P. Schone
Mrs. G. W. Stewart
Mrs. H. C. Thompson
Mrs. A. W. Volkmer
Mrs. E. L. Waterman
Mrs. S. M. Woodward

SECTIONS AND BRANCHES.

A meeting of the **Minnesota Section** of the S. P. E. E. was held April 19, 1926, at 5:45 p.m. Dinner was served at the Campus Club, University of Minnesota, after which a paper on "Collegiate Training for the Radio Engineer" was read by Professor C. M. Jansky.

Professor D. G. Paterson then introduced Mr. T. A. Langlie, who talked on "Freshman Placement Examinations" in the Engineering College at the University of Minnesota. Mr. Langlie's talk was accompanied by a number of charts made up from the results of placement examinations and the results actually attained by the students who took these examinations in their college work later.

The talk was informal and was interspersed with many questions and followed by a very lively discussion.

President R. E. Kirk announced the appointment of the following nominating committee:

Professor F. B. Rowley, *Chairman*,
Professor M. E. Todd,
Professor R. E. Montonna.

B. J. ROBERTSON,
Secretary.

The tenth meeting of the **New England Section** of the Society was held at the Massachusetts Institute of Technology, Cambridge on Saturday, May first. This was the fifth annual meeting and the first meeting to be held at one of the colleges in Greater Boston. In the absence of Acting President Boardman, the secretary of the Society, Professor William H. Timbie was appointed secretary pro tem.

The morning session was held at 10 A.M. and opened with a welcome from President Stratton who greeted the members with remarks relating to the importance of our assembly and offering us the freedom of the institution. After announce-

ments by the Chairman of the local committee, the members were invited to visit the laboratories of the institution which included a list of about thirty points of interest.

At twelve o'clock the members assembled in the faculty room of the Walker Memorial for individual conferences and at 12:30 partook of a luncheon as guests of the Institute.

The afternoon session was held at 2:30. The entire session of more than two and one half hours was devoted to the report of Director Wickenden on the most recent developments of the Board of Coördination and Investigation. Within the allotted period, he presented the live issues which are now before engineering educators and this was done with a completeness and logical arrangement which made clear to all the magnitude of the work and the great value of the results which engineering educators have anticipated might become a reality.

All of the important tables and diagrams were presented by slides which enabled Mr. Wickenden to concentrate the attention of the Society on the vital issues which we have before us with the result of making all of those present appreciate the importance of the Iowa meeting and their desire to become a part of it. It was universally agreed by those in attendance that it was the most helpful as well as the most interesting address they had ever heard.

At 6 P.M. a dinner was served at the Walker Memorial which was immediately followed by a short business meeting and report of the chairman. The session was opened by the customary reading of the constitution which was read by its author, Professor C. Frank Allen, retired. Following this the meeting was opened for the discussion of the subjects chosen for the session.

The topics for discussion were:

1. Selective Admission.
2. What should be done for the exceptional, or honor students?

As the members in attendance at this dinner represented the most advanced educational thought in New England, it

was productive of a very interesting discussion. A vote of thanks was extended to the Massachusetts Institute of Technology for the courtesies of the occasion and the luncheon to the members.

There were present at the several sessions 75 members representing the following institutions: Massachusetts Institute of Technology, Harvard College, Tufts College, Worcester Polytechnic Institute, Wentworth Institute, Brown University, Yale University, Franklin Union, Vermont University, University of Maine, Norwich University, Thayer School, Dartmouth College, Northeastern University, University of New Hampshire, Trinity College, Rhode Island State College and S. P. E. E. Staff.

GARDNER C. ANTHONY,
Chairman.

The **Purdue Branch** of the Society met with the Chemistry Department on the evening of May 14th, for the fourth and final meeting of the school year.

A paper on Instruction in Chemistry, was presented by Prof. A. R. Middleton, acting Head of the Chemistry Department, in which recent discoveries and their effect upon teaching methods were discussed. Present and proposed curricula in the department were also commented upon.

Prof. R. E. Nelson presented a paper dealing with the general subject, Chemistry for Engineers, in which the subject matter and teaching methods pertaining to courses in Chemistry for Engineering students at Purdue, were presented. Following this paper there was a general discussion of teaching methods, content of courses, etc. Dean A. A. Potter emphasized the fact that there is likely to be objectionable duplication of subject matter in different courses unless, through the agency of such meetings as that then in progress, the various departments and instructors acquaint themselves with the contents of courses in related subjects.

Prof. L. A. Test presented the results of the so-called Iowa Placement Tests, which were recently given the entering

freshmen at Purdue and by means of various charts showed the correlation betwen the results of these tests and the succeeding first semester grades. This was succeeded by an interesting discussion on the general subject of Placement Tests.

Election of officers for the ensuing year resulted in the selection of Prof. A. P. Poorman, of the Department of Aplied Mechanics, for Chairman and of Prof. J. L. Bray, of the School of Chemical Engineering, for Secretary.

The meeting adjourned at 9:50 P.M. Attendance, 40.

G. C. BLALOCK,
Secretary.

OBITUARY.

JOHN J. FLATHER.

The death of Professor John J. Flather of the University of Minnesota which occurred on Friday, May 14, 1926, at his home in Minneapolis, came as a surprise and a shock to his many friends. Although he had not been in the best of health for several years, his usual energy enabled him to perform his full duty as a teacher and as the administrative head of the Department of Mechanical Engineering. Quite recently he has had trouble with his heart and just a day or two before his death his physician ordered a complete rest and cessation of all active work. Professor Flather was at the University up to the day before his death.

Professor Flather was born at Philadelphia, June 9, 1862. His father was English and his mother, a native of Virginia. He was educated in private schools in Scotland, and the high school at Bridgeport, Conn., later attending Yale University where he graduated in 1883. He did graduate study at Cornell University and received the degree of Master of Mechanical Engineering in 1890. He also studied at the University of Edinburgh.

The early professional experience of Professor Flather includes a full apprenticeship in various machine shops in New England, journeyman experience as a toolmaker for the Yale and Towne Mfg. Co., designer and foreman for the Ansonia Electric Co., and superintendent of the Buffalo Steam Pump Co., and afterwards of the Hotchkiss Mfg. Co., of Bridgeport, Conn.

In 1888, he began his teaching work as instructor in mechanical engineering at Lehigh University, where he remained three years. From 1891 to 1898, he was Professor of Mechanical Engineering at Purdue University. He came to the University of Minnesota in 1898 as Professor of Mechanical Engineering and Head of the Department, which position

he held until his death. He has taught practically all of the subjects in the mechanical engineering curriculum at some time during his career. His department has developed under his leadership and guidance from a small unit to a group of nearly 200 students and a faculty and staff of twenty-five. Many prominent mechanical engineers and engineering teachers are the product of this department.

Professor Flather has taken an active part as consulting engineer in many important engineering projects in the Northwest. Among these are municipal water works, electric light plants, factories, and power plants. He designed the heating plants for the University of Minnesota on the Main Campus and the Farm Campus. He also conducted many researches and investigations, especially along lines of mechanical power development, transmission and measurement, and the design of tall chimneys.

His articles in the technical journals have been numerous and cover a broad field. He is the author of books on rope driving, dynamometers and the measurement of power, and kinematics, and joint author of books on steam boilers and engineering thermodynamics. At the time of his death he had partially completed a work on the history of engineering.

He was a member of various societies, principally scientific and technical, including the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, Society of Industrial Engineers, Minneapolis Engineers' Club, American Association for the Advancement of Science (secretary and vice-president of Section D), Society for the Promotion of Engineering Education (treasurer and later vice-president), American Association of University Professors, and the honorary societies Sigma Xi, Tau Beta Pi, and Pi Tau Sigma. He was also a member of the Authors' Club and the Newcomen Society of London.

Professor Flather was a cultured gentleman of broad vision. Outside of his professional and scientific interests, his tastes ran to literature. He enjoyed a wide acquaintanceship throughout the United States and in various foreign coun-

tries. He was a delightful conversationalist, versed in many subjects.

Professor Flather was a member of the Society since 1893.

George Burr Wharen.

Professor George Burr Wharen was born in Wilkes-Barre, Pennsylvania, October 14, 1883, and died at Grand Forks, North Dakota, May 1, 1926. He received the Bachelor of Science degree from Pennsylvania State College in 1910, and Master of Science degree in 1913. He was for a time connected with the Drafting Department of the American Locomotive Company at Schenectady, New York; with the Motive Power Department of the Pennsylvania Railroad at Altoona, Pennsylvania, and was instructor in Mechanical Drawing at Wentworth Institute, Boston, and in Mechanical Engineering at the University of Pennsylvania.

In 1920 he became head of the Department of Mechanical Engineering of the University of North Dakota and held that position until his death. He was one of the ablest combustion engineers in the northwest and had become an authority on the use of North Dakota lignite in pulverized form for power plant combustion. The State of North Dakota contains enormous quantities of fuel of this type, which will become one of the most valuable natural resources of the nation, when the most efficient methods for its use are completely developed. The early death of Professor Wharen is in every way unfortunate and is deeply regretted.

Professor Wharen was a member of the Society since 1922.